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ABSTRACT

The epistemological beliefs of teacher-credential students were studied to determine if their beliefs change in sophistication after a semester of training. Also studied was the extent of the relationship between academic and home background variables and epistemological beliefs. A convenience sample of 52 white females in their fifth year of college education provided data for the study. A pretest and posttest design was used. The dependent variable was measured by a linear-composite score computed from the 34-item version of M. Schommer's (1990) Epistemological Beliefs Questionnaire. A simple demographic survey and a writing task were included with the questionnaire during the posttest. Findings indicate that the distribution of epistemological beliefs obtained from teacher-credential students is about the same as that obtained from undergraduate teacher majors and junior college faculty. Change to greater levels of epistemological beliefs sophistication was found from pretest to posttest. Individuals with prior teaching experience obtained greater levels of sophistication than individuals with no prior teaching experience. No statistical difference was found between individuals holding different undergraduate majors or from different undergraduate institutions. Correlation coefficients indicated important relationships between home background and the epistemological beliefs of individuals. The writing task provided additional information on the beliefs of individuals about teaching and learning prompted by a teaching scenario that could not be yielded from a questionnaire with a structured format. Based on the results of this study, it is concluded that the epistemological beliefs of individuals change to greater sophistication over a semester of training as the result of increased personal reflection on teaching and learning and obtained teaching experience. An appendix contains the raw score conversion table for the 34-item questionnaire which is included. (Contains 4 figures, 14 tables, and 34 references.) (Author/SLD)

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Running Head: EPISTEMOLOGICAL BELIEFS OF TEACHER CREDENTIAL STUDENTS

Epistemological Beliefs Of Teacher Credential Students

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The purpose of this study was to investigate the epistemological beliefs of teacher-credential students, determine if their beliefs change in sophistication after a semester of training, and to investigate the extent of the relationship between academic and home background variables and epistemological beliefs. A convince sample (N = 52) of mostly White females who are in their fifth year of college education provided data for this study. A pre- and posttest design was used to address the questions that framed the investigation for this study. The dependent variable was measured by a linear-composite score computed from the 34-item version of Schommer's (1990) Epistemological Beliefs Questionnaire. A simple demographic survey and a writing task were included with the questionnaire during the posttest. Findings indicated that the distribution of epistemological beliefs obtained from teacher-credential students is about the same that obtained from undergraduate teacher majors and junior college faculty. Change to greater levels of epistemological beliefs sophistication was found from pre to posttest. Individuals with prior teaching experience obtained greater levels of sophistication than individuals with no prior teaching experience. No statistical difference was found between individuals holding different undergraduate majors or from different undergraduate institutions. Correlation coefficients indicated important relationships between home background and the epistemological beliefs of individuals. The writing task provided additional information on the beliefs of individuals held about teaching and learning prompted by a teaching scenario that could not be yielded from a questionnaire with a structured format. Based on the results of this study, it was concluded that the epistemological beliefs of individuals change to greater sophistication over a semester of training as the result of increased personal reflection on teaching and learning and obtained teaching experience.

Epistemological Beliefs of Teacher Credential Students

Epistemological beliefs or one's personal beliefs about the source of knowledge and nature of knowledge are thought to develop slowly from a naive view of the world to one of increased sophistication with higher education (Perry, 1970). The evidence indicates that higher education, age, and family background are important to foster greater sophistication in the epistemological beliefs of individuals (Schommer, 1990, 1992, 1993a, 1993b). Furthermore, evidence is provided that increased epistemological beliefs sophistication is related to higher reading comprehension (Ryan, 1984a, 1984b), reflective judgment (Bendixen, Dunkle, & Schraw, 1994), and academic performance for math and science (Hashweh, 1996; Qian & Alvermann, 1995; Schommer, 1992; Schommer, Crouse, & Rohdes, 1992) for secondary and postsecondary students. Yet, evidence to determine the range of sophistication in epistemological beliefs of teacher-credential students in their fifth-year of education remains to be found.

The primary purpose for this study was to investigate the epistemological beliefs of individuals preparing for a teaching credential. The second purpose of this study was to investigate, if after a semester of training the epistemological beliefs of teaching-credential students change in sophistication. The third purpose for this study was to investigate the extent of the relationship between students' academic background variables and their epistemological beliefs.

These three purposes of investigation raised questions for this study based on research evidence starting with William Perry's (1970) seminal work with Harvard college students. Perry and his followers laid the theoretical groundwork for studying intellectual and moral development (Perry, 1970; Ryan, 1984a, 1984b), "*women's ways of knowing*" (Belenky, Clinchy,

Goldberger, & Tarule, 1986), reflective judgment (Kitchener & King, 1981), and epistemological beliefs development (Schommer, 1990).

Based on the evidence, researchers are beginning to understand the nature of personal beliefs and the ways in which epistemological beliefs affect learning. Concern is raised about the level of epistemic development of individuals in teacher training. Beers (1988) reasoned that poor epistemic development interferes with on-the-spot decision-making ability and problem-solving strategies that teachers reveal in the classroom when interacting with students. Beers argued teacher educators have the opportunity to foster professionalism in pedagogy by having students think about their epistemological beliefs using discussion and reflection.

According to Pajares (1992), change in an individual's beliefs requires a gestalt shift, because "beliefs are formed early and tend to self-perpetuate, persevering even against contradictions caused by reason, time, school, or experience" (p. 324). If the belief is in Pajare's terms "hardy," then a bias consistent with an individual's belief can override knowledge that conflicts with the belief, regardless of the truth of the information. A teacher may avoid learning new teaching practices that conflict with long-held personal beliefs even if that method of teaching has been shown to be a necessary part of the learning process. Based on a review of the literature, Pajares posited 16 assumptions about beliefs that teachers, researchers, and teacher educators need to be aware of, for example, "Epistemological beliefs play a key role in knowledge interpretation and cognitive monitoring" (p. 325).

Indeed, the affect of personal beliefs about teaching and learning on the transfer of professional knowledge into practice for individuals in teacher training is not explained adequately by the advances in cognitive science (Fenstermacher, 1994). Korthagen and Kessels (1999) attribute the problem of transferring theory to practice to causes such as the use of formal

learning process within teacher-training institutions. Many individuals on entering a teacher credential program view their role of teaching as a process of transmitting knowledge instead of helping students actively construct and synthesize knowledge (cf., the review by Brookhart & Freeman, 1992). Another transfer problem is attributed to poorly developed action-guided knowledge that a teacher falls back on instead of research-based expert knowledge when making on-the-spot decisions in the classroom (cf., Beers, 1988).

The problem of ineffectively transferring research-based professional knowledge and inability to foster professionalism in teacher education programs may be the result of individuals holding onto naive epistemological beliefs about teaching and learning. It is for this reason that the epistemological beliefs of teacher-credential students need investigation.

Schommer (1990) defined epistemological beliefs as independent epistemic dimensions so that personal epistemology is conceptualized as a complex system of beliefs. Other researchers have drawn from and extended the work of Perry (1970) where personal epistemology has been conceptualized as a unitary dimension. Schommer (1990) argued that a unitary conceptualization for personal epistemological development regarding learning is limited and that personal epistemology is more likely to be a multidimensional belief system. Schommer reasoned that a more accurate conceptualization of personal epistemology is based on studies that have found inconsistent results to support a unitary personal epistemology dimension (cf., Glenberg & Epstein, 1987; Ryan, 1984a, 1984b), and research that has indicated multidimensionality (Bendixen et al., 1994; Jehng, Johnson, & Anderson, 1993; Schommer, 1990, 1993a, 1993b), which Schommer (1990) labeled as epistemological beliefs.

To contribute new evidence regarding the epistemological beliefs of teacher-credential students to educators, researchers, and others concerned with teacher education, the following research questions were addressed for this study:

1. What are the epistemological beliefs of teacher-credential students preparing for a teaching credential?

2. To what extent will a change take place in individuals' pre- and posttest epistemological beliefs scores and will the extent of a change be different between first semester teacher-credential students and third semester teacher-credential students?

Research suggests that individuals enter a teaching-credential program with different educational experiences and beliefs about the purpose of education (cf., Schommer, 1992, 1993b, 1998). Therefore, additional investigation was made to answer the following research questions:

1. To what extent will first-semester students' epistemological beliefs pretest scores be different from third semester student's epistemological beliefs pretest scores?
2. To what degree will teacher-credential students' epistemological beliefs change after completing a semester of training that encourages individuals to reflect on their teaching practices?
3. To what extent will a change take place in teaching-credential students' pre- and posttest epistemological beliefs scores and will the extent of a change be different between individuals grouped by personal teaching experience?
4. To what extent will teacher-credential students' epistemological beliefs pretest scores be different between individuals holding undergraduate majors in diverse areas of study?
5. To what extent will teacher-credential students' epistemological beliefs pretest scores be different between individuals from diverse types of educational institutions?

6. To what degree will teacher-credential students' CBEST scores be related to their epistemological beliefs pretest scores?
7. To what degree will family academic background be related to teacher-credential students' epistemological beliefs pretest scores?

Method

Sample

Data were collected from a convenience sample of 52 individuals in their fifth year of college education preparing for a teaching credential within a private Roman Catholic 4-year institution located in the San Francisco Bay Area within the state of California. The demographic data that were collected at the posttest are given in Tables 1 and 2. Missing demographic data were the result of 2 first-semester students who left the program, and 17 (4 first-semester and 13 third-semester) students who were present for the pretest but not the posttest. Data, however, were recovered from two students by requesting that faculty send demographic forms to all students who were present at the pretest and asking only those who were not at the posttest to complete the form and return it in the pre-addressed envelope provided by the researcher.

INSERT TABLES 1 AND 2 ABOUT HERE

Typical of most teacher-credential programs in the state of California, the majority of the sample in this study are White females who hold an undergraduate major in interdisciplinary or humanities subject areas from a public 4-year higher education institution (see Table 1). Most respondents reported that family members and spouses are well educated (see Table 2).

Design

A pre- and posttest design was used to address the questions that framed the investigation of the epistemological beliefs of teacher-credential students. The dependent variable was measured by a linear-composite score computed from the Comerford et al. (1999) 34-item revised version of the 63-item Epistemological Beliefs Questionnaire (Schommer, 1990). The questionnaire was used to collect pre- and posttest data from first- and third-semester teaching credential students in the Spring 2000 semester. A simple demographic survey and a writing task were included with the questionnaire during the posttest. The writing task was constructed as an open-ended measure with the intent to yield richer information regarding students' beliefs about teaching and learning that a questionnaire designed with structured response options does not provide. The demographic survey and writing task are provided in the Appendix.

During the 18-week Spring semester, Philosophical Foundations and Educational Psychology were attended by first-semester students and Student Teaching I & II were attended by third-semester students (see Table 3). In their first semester of training, students are required to take Educational Psychology and Philosophical Foundations, where formal assumptions and perspectives about teaching and learning are studied, reflected on, and discussed. Third-semester students take Student Teaching I & II, where one of the requirements is to write a final-semester essay on one's personal philosophy about teaching based on classroom teaching experiences.

INSERT TABLE 3 ABOUT HERE

First-semester students normally enter the program without any teaching experience, whereas, students in their third semester are teaching full or part time. The number of students

that were classified by their teaching experience into two groups labeled as prior experience and no prior experience for the entire sample and for semester in training are shown in Table 4. Individuals may or may not have been teaching at the time data were collected for this study. Student teaching does not occur until the third semester of training, yet these data indicate that several first-semester students have prior teaching experience. If individuals are teaching on an emergency credential, then they have been supervised by a mentor with at least 3 years of teaching experience as required by the California Commission on Teacher Credentialing (cf., McLean, 1999).

INSERT TABLE 4 ABOUT HERE

Procedure

Data collection took place during class time in the 18-week Spring 2000 semester. Faculty scheduled the days and times for the researcher to enter the classroom. Specifically, pretest administration took place during the first week of the three classes. The posttest was administered 11 weeks later for first-semester students attending Philosophical Foundations and Educational Psychology. The posttest was administered 17 weeks later to third-semester students attending Student Teaching I & II.

Students were told that serving as a participant in the study is voluntary and approximately 10 to 15 minutes of time was needed to provide instructions and administer the pretest. If a student did not want to serve as a participant, then she or he could read quietly. Students were assured that by not choosing to serve, as a volunteer would in no way affect their grade or course work. The researcher then administered the Comerford et al. (1999) 34-item

Epistemological Beliefs Questionnaire. Instructions for filling out the questionnaire included asking participants to record a unique code that only he or she could later recall for the purpose of keeping pre- and posttest measures together while assuring anonymity. Approximately 20 minutes of time was needed to provide instructions and administer posttest measures. After the posttest, participants were debriefed about the study.

Epistemological Beliefs Questionnaire

To test the hypothesis that epistemological beliefs are multidimensional, Schommer (1990) constructed the 63-item Epistemological Beliefs Questionnaire with some items drawn from the work of others, for example, Perry's (1970) interview questions. Respondents are instructed to rate the extent of their agreement with each statement on the epistemological questionnaire using a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Schommer wrote her 63 items such that a naivé person was likely to disagree with 27 statements from the questionnaire and agree with 36 statements from the questionnaire, whereas a sophisticated individual is likely to respond in the reverse direction on the scale. To score items from the questionnaire, responses to the 5-point Likert scale are reversed for the 27 negatively-worded statements. The result is a response scale where a low score indicates a sophisticated response and a high score indicates a naivé response for each of the 63 items. Schommer (1998) provided the complete copyrighted list of the 63 statements from the Epistemological Beliefs Questionnaire in a recent study.

Schommer based her items on five dimensions of epistemological beliefs: Certain Knowledge, Omniscient Authority, Simple Knowledge are directly derived from Perry's (1970) work, and Innate Ability and Quick Learning were contributed by Schommer (see Table 5). Items were then grouped by Schommer (1990) into the following 12 subsets. *Seek Single*

Answers (11 items), *Avoid Integration* (8 items), *Avoid Ambiguity* (5 items), *Knowledge is Certain* (6 items), *Don't Criticize Authority* (6 items), *Depend on Authority* (6 items), *Can't Learn How to Learn* (5 items), *Success is Unrelated to Hard Work* (4 items), *Ability to Learn is Innate* (4 items), *Learning is Quick* (5 items), *Learn the First Time* (3 items), and *Concentrated Effort is a Waste of Time* (2 items).

INSERT TABLES 5 ABOUT HERE

In the 1990 study, Schommer employed factor analytic techniques to derive four factors from these 12 subsets used as variables. Schommer labeled the factors as *Fixed Ability*, *Quick Learning*, *Simple Knowledge*, and *Certain Knowledge*. Schommer points to evidence of reliability and validity for the 63-item Epistemological Beliefs Questionnaire based on a series of studies that began in the early 1990s (Schommer, 1990, 1993a, 1993b; Schommer et al., 1992).

Not all researchers have been successful in identifying Schommer's proposed 4-factor structure. For example, after revising Schommer's questionnaire and adding items from Spiro's 1989 questionnaire, Jehng et al. (1993) found five epistemological dimensions using confirmatory factor analysis. In the Bendixen et al. (1994) study, four factors were found after reducing the 63-item questionnaire to 34 items. Qian (1993) found three factors after carrying out a principal component factor analysis using only 32 items from Schommer's questionnaire.

In the Comerford, Busk, Roberts and Blumberg (1999) study, the Epistemological Beliefs Questionnaire (Schommer, 1990) was assessed for empirical support by first determining the factor structure employing the 12 subsets used as variables and then investigating the factor structure at the item level on a sample of 1,079 college students. The sample represented three

data sets. The first data set included a sample of 123 community-college students from English classes that served in the pilot study for Comerford's (1999) dissertation research. The second data set included a sample of 786 undergraduates enrolled in 38 sophomore-level transfer classes at the same community college. The third data set included a sample of 170 upper-division (junior and senior) teacher-education majors enrolled in a state college. The first two data sets were used to establish reliability and the factor structure of the questionnaire. The third data set was used to obtain evidence of validity for the questionnaire. In addition, data collected at the community college included responses to the questionnaire from 28 faculty members as part of the study, but data from faculty were not used with students' data in tests of reliability and factor structure.

Comerford et al. (1999) concluded from the results of two separate principal component factor analysis (one using Schommer's (1990) method of scoring and the second using simple sums as total scores for the 12 subsets) that Schommer's proposed factor structure could not be recovered adequately at the item level. A three-factor solution was a consistent finding from the parallel analyses, but the structure of items and variables were not the same as Schommer's 4-factor solution. Results showed that internal consistency and test-retest reliabilities for secondary factors were unsatisfactory.

An additional analysis of the data was carried out by Comerford et al. (1999) to try and uncover the underlying structure of Schommer's (1990) Epistemological Beliefs Questionnaire using rating-scale analysis techniques. Rating scale-analysis provides a mathematical model that is an extension of Rasch's Dichotomous model (cf., Chapter 3 for a comparison of the family of models in Wright & Masters, 1982). According to proponents of Rasch measurement, constructing a variable by summing items into a total scale score leads to measurement

problems. Furthermore, computing average scores involve summation; therefore, previous research that has provided unclear results for the structure of the Epistemological Questionnaire possibly are due to using unreliable scale scores to derive factors.

Two problems arise for variables that are measured by adding the responses of items into a total score, which is a common practice for Likert response scales (cf., Lincre, 1999; Wright & Masters, 1982). The first problem arises with raw additive scores, because they cannot be expressed on a linear scale. Simplest statistics, such as, means and standard deviations assume linearity otherwise the results can be distorted. A second problem of additive raw scores is that their values depend on the responses of the sample and the characteristics of the written items. For example, acquiescence and the need to project a positive image of one's self is a particular problem for Likert scales.

A solution to these problems is to transform raw scores to measures in which linearity is assured. Wright and Masters (1982) argued that such a transformation can be accomplished effectively with Rasch's mathematical model that relates parameters in such a way that "person parameters can be conditioned out of the model when items are calibrated to obtain sample-free calibrations, and item parameters can be conditioned out when persons are measured to construct test-free person parameters" (p. 4). Thus, the transformed scale provides scores that meet the assumption of linearity required for many statistical methods. Furthermore, the raw scores from new samples can be converted directly to transformed scores, providing the same items are used and conditions that varies person ability or attitudes in the case of ratings are similar.

Comerford et al. (1999) applied Andrich's Rating Scale model to Schommer's (1990) Epistemological Beliefs Questionnaire. Item writers intend that respondents perceive each category on the rating scale as equally spaced and of equal importance. In reality, however,

categories on a rating scale may not be perceived by respondents in the intended way. It becomes problematic when the way in which categories are divided among observations affect the reliability of the measure (Lincare, 1999, p. 107). Based on a set of observations, rating scale analysis provides techniques to determine how many categories of a rating scale maximize perceived category distinctiveness improving reliability for the measure.

Examination of observations given to categories of the rating scale in the Comerford et al. (1999) study showed that most items were skewed to the right severely affecting step calibrations and lowering reliability. The problem can often be corrected with a logical recoding of responses on the rating scale (cf., Lincare, 1999).

For the revised questionnaire, 34 of the 63-item statements provided item calibrations above .50, indicating good-to-adequate probability for constructing a variable to measure the epistemological beliefs of individuals. The column in Table 5 displaying the 34 items shows that 15 items are from Perry's (1970) questionnaire respective of Certain Knowledge, Omniscient Authority, and Simple Knowledge and 19 items were added by Schommer (1990) respective of Quick Learning and Innate Ability. Good internal consistency (alpha = .84) was found for these 34 items, although overall test-retest reliability (.61) for the 34-item Rasch scale in the 18-weeks of data collection was not satisfactory. Evidence for validity was obtained from the third data set consisting of upper-division teacher education majors using linear scale scores from the 34-item Epistemological Beliefs Questionnaire.

Research indicated that epistemological beliefs mature slowly over time with increased academic experience. Comerford et al. (1999) reported that a comparison between teachers and their students on the revised 34-item Epistemological Beliefs Questionnaire was statistically significantly different (paired t test = 3.42, df = 27, effect size = .87). Teachers' Rasch-scaled

scores ranged from 37.78 to 56.70, with only 3% of students having epistemological beliefs scores more sophisticated than the two teachers with the most sophisticated epistemological beliefs score of 37.78 and 16% of the students having lower epistemological beliefs than the teacher with the highest score of 56.70. The fact that 16% of college students in Comerford et al. study had lower epistemological beliefs than the teacher with the highest score, indicated validity for the hypothesis that those who have greater educational experience, such as community-college teachers, demonstrated greater development in sophistication for epistemological beliefs than undergraduate students with less experience.

Scoring

Total scores were obtained by summing responses to individual items from the 34-item questionnaire. Respondents total-response scores were then directly transformed to linear measures using the conversion table in the Appendix. Transformed measures will be referred to as scale scores from this point forward, where low scale scores represent sophistication and high scale scores represent less sophistication or naive epistemological beliefs.

The steps necessary to carry out the linear transformation of teacher-credential students' raw scores to scale scores will be described next. First, responses from the 34-item questionnaire given to 17 statements that a naivé individual is likely to agree with are reversed on the 5-point Likert scale. Reversing the scale for responses to these 17 items orders all items along the response scale so that a low score indicates sophistication and a high score indicates naivé epistemological beliefs. It is necessary for Rasch rating scales to start with zero; therefore, the scale was rescored to 0 (*Strongly Disagree*), 1 (*Disagree*), 2 (*Neither*), 3 (*Agree*), and 4 (*Strongly Agree*). It was also necessary to logically combine points into a 3-point scale (0,1,222) to improve step calibrations. The new 3-point scale is labeled as 0 (sophisticated), 1 (moderate

sophistication), and 2 (low sophistication). Based on the 3-point scale, responses to the 34 items are first summed into a composite raw score and then transformed to a linear scale score using the transformation table in the Appendix.

Cronbach's coefficient alpha (.83) determined acceptable reliability for teacher-credential students' (n = 52) pretest scale scores on the 34-item Epistemological Beliefs Questionnaire, although poor pre- and posttest reliability--11-week period for first-semester students and a 17-week period for third-semester students--was indicated at .57 for students (n = 33) with complete pre- and posttest data.

Scale score cutoffs from the 34-item questionnaire used to place students into low, moderate, and high groups has not been established; therefore, cutoffs for scale scores are determined by matching scale scores with specific logits from the conversion table in the Appendix. Scale scores that correspond with one half logit above (.50) and one half logit below (-.50) the center of the scale are 45.46 and 54.60, respectively. Thus, scale scores below 45.56 are used to indicate sophistication, scale scores between 45.56 to 54.60 are used to indicate moderate sophistication, and scale scores above 54.60 are used to indicate low sophistication in respondents' epistemological beliefs. Setting cutoffs a half logit from the center of the scale in either direction may provide an optimal point for regrouping epistemological beliefs scale scores into simpler ordered categories (cf., Wright & Masters, 1982).

Writing Task

The writing task for this study was constructed with the purpose of providing supplemental qualitative information regarding teacher-credential students' beliefs about teaching and learning that a questionnaire designed with structured response options does not provide. The supplemental information may help to determine if similar or different points of view

regarding beliefs about teaching and learning are perceived by teaching-credential students as that proposed by other researchers (cf., Pajares, 1992).

Following the method used by other researchers (cf., Pajares & Bengston, 1995), the writing task was constructed with a scenario followed by three prompts regarding teaching and learning (see Appendix). Several considerations can affect a teacher's decision about what is best for a student who is low in science and mathematics achievement, for example, adjust the curriculum to meet special needs, provide the student with extra time in or out of the classroom for tutoring, or what knowledge is sufficient for a particular subject area. Each of these and other considerations are likely to be revealed in a teacher's beliefs about the purpose of teaching and learning.

The scenario was written with the intent to depict a teacher who must decided how to help a student who is having difficulty with mathematics and science but achieves well in language and reading. Based on the comments and suggestions of teaching-credential faculty, the scenario and 3 prompts were revised several times before piloting the writing task to teacher-credential students. Results obtained in the pilot for Roberts' (2001) dissertation research are presented next.

In general, respondents found the writing task clear and relevant to administer to individuals in a teacher-credential program. Participants felt that the scenario described a situation that teachers must deal with in their classrooms. For example, one respondent said that a similar situation recently had occurred for her in the classroom where she teaches. Respondents were concerned that teachers would react adversely to a sentence that referred to students low or high in science and math ability. The first couple of sentences in the scenario were rephrased to scoring below or above a given percentile eliminating the word ability.

Two raters coded each question using the following process: Each question was assigned a number corresponding to one of the 12 categories respective of the 6 themes that emerged from students' written responses. For example, if a rater determined that the respondent expressed the belief about making thoughtful decisions (category 2) in answering question one, then the rater would give the response a two. It was possible to assign a code from more than one category. After coding the question, the rater moved on to the next question until all respondents' statements had been evaluated. Before consultation, the agreement between raters (32 disagreements and 27 agreements) on coding the writing task for the pilot study was unacceptable. Raters discussed their evaluations in the attempt to reach better agreement.

After reviewing written statements from the pilot study, raters decided to collapse the 12 categories into four beliefs labeled as (a) It is a teacher's professional responsibility to foster learning behavior in all students for all subject areas, (b) Giving students the correct answer is an integral part of acquiring knowledge at the beginning when learning a new subject, (c) The active process of continued learning deserves greater weight than simply teaching rote methods on how to solve problems, and (d) Teachers who are willing to spend extra time with a student is an indication of educators who make thoughtful decisions. For each question, each of the four beliefs were coded with the following criteria: Not expressed in any way (0), expressed implicitly in words or phrases (1), and expressed explicitly in words or phrases (2). Codes 0 and 2 are mutually exclusive of one another; that is, it was the job of each rater to determine if the individual's written statements did not express the belief at all or contained words and phrases that explicitly stated the targeted belief. Raters used one to code written statements where words or phrases implied ideas similar to the targeted belief, but words or phrases did not explicitly state the belief.

The writing task was written with the intent to elicit as many beliefs about teaching and learning as possible with three short prompts. The four beliefs that emerged from the writing task were not necessarily elicited by the same prompt. In several attempts, raters were unable to reach adequate agreement coding statements for each belief in each of the three question prompts; therefore, it was decided to evaluate the writing task as a whole for each targeted belief. Acceptable rater agreement (86%) for the writing task from the pilot study was reached as the result of these changes. The final version of the writing task was administered once during the posttest.

Results

To determine if sample loss affected the pre- and posttest analysis, an independent *t* test was used after dividing the pretest data into two groups. Group one included students with complete pre- and posttest scale scores (mean = 48.02, standard deviation = 5.45) and group two include students with a single pretest scale score (mean = 45.75, standard deviation = 8.34). Test results showed that pretest scale scores were not statistically significantly different between students who had complete pre- and posttest data and those who did not, $t(50) = 1.19$, $\hat{\eta}^2 = .03$. Findings indicate that the effects of attrition are not likely to bias the results of data analysis in this study. No statistically significant difference on pretest scale scores was attributed to gender, $t(35) = -1.55$, $\hat{\eta}^2 = .06$ or to ethnic differences, $t(35) = .37$, $\hat{\eta}^2 = .06$.

Box-and-whiskers plots in Figure 1 present distributions of sophistication in epistemological beliefs scale scores for teachers and teacher majors from the Comerford et al. (1999) study and teacher-credential students in this study. Means and standard deviations were computed for additional group comparisons (see Table 6). Results indicate that the range of sophistication in epistemological beliefs is about the same for all teacher groups and that the

group with the narrowest score range is faculty. Except for a few, the majority of individuals are near scale average sophistication in one's epistemological beliefs.

INSERT FIGURE 1 AND TABLE 6 ABOUT HERE

The first major research question is what are the epistemological beliefs of teacher-credential students? Pretest means and standard deviations by teacher-training groups are displayed in Table 7. The lowest scale score was obtained by a first-semester student and indicates high sophistication, whereas individuals in both groups obtained the highest scale score. Group standard deviations are about the same.

INSERT TABLE 7 ABOUT HERE

Box-and-whiskers plots displayed in Figure 2 provide a graphical picture of scale scores that displays group medians, quartiles, and extreme values. Each box represents the interquartile range that contains 50% of the scores obtained by group members. The median line within the interquartile range is slightly higher for third-semester students (difference = 1.31). The two circles in Figure 2 mark the two outliers found that extend past the lower whiskers of the box plots, although no extreme values were found in either group. The graphical evidence suggests that teacher-credential groups attending beginning and ending semesters of training are nearly the same on pretest scale scores that were obtained from the 34-item epistemological beliefs questionnaire. The independent-sample *t* test determined that first- and second-semester teacher-

credential students are not statistically significantly different on pretest scale scores, $t(50) = -.38$, $\hat{\eta}^2 = .04$.

INSERT FIGURE 2 ABOUT HERE

Students were grouped into three categories of epistemological beliefs sophistication, where scale score intervals are used to designate categories as *sophisticated* (scale scores range from 0 to 45.56), *moderate sophistication* (scale scores range from 45.56 to 54.60), and *low sophistication* (scale scores range from 54.60 to 100.0). The percentage of students within each of these constructed categories are shown in Table 8. More than a third of the students are grouped as sophisticated, slightly better than half of the sample are grouped as moderate in sophistication, and about 10% of the sample are grouped as low in epistemological beliefs sophistication.

INSERT TABLE 8 ABOUT HERE

Means and standard deviations from pre- and posttest scale scores for the total sample and for first- and third-semester teaching-credential students are presented in Table 9. Posttest means for scale scores were noticeably lower than pretest means for scale scores for third-semester students (mean difference = 3.30), whereas posttest means for scale scores were about the same as pretest means for scale scores for first-semester students (mean difference = .19). The graphical display of pre- and posttest means for first- and third-semester students is provided in Figure 3.

INSERT FIGURE 3 AND TABLE 9 ABOUT HERE

Two third-semester students were identified with extreme pretest scale scores as shown in Figure 3. The first extreme score on the pretest (36.01) was obtained by a third-semester student who obtained the second lowest score (42.46) on the posttest, indicating high epistemological maturity at both test times. The second extreme pretest score (40.21) was obtained by a third-semester student who scored above the five lowest posttest scores with a 45.94, indicating a change from sophisticated to moderate epistemological beliefs sophistication. After checking the pre- and posttest scores for the two students who obtained the extreme pretest scores shown in Figure 3, it is concluded that their scores are acceptable and should not be dropped from the analysis.

A two-factor analysis of variance, where one factor is repeated, was used to test the next research question to determine if the amount of change from pre- to posttest for first-semester students was the same amount of change for third-semester students. Results of evaluation of assumptions for normality and independent groups were satisfactory. The assumption for homogeneity of variance-covariance was rejected by Box's M test at 2% chance of being in error. Marascuilo and Serlin (1988) provide a useful strategy of analysis when *compound symmetry* in the data is problematic. The following method will yield close to a 5% Type I error rate. First, complete the common factor analysis of variance test. If the results are statistically significant, then apply the Geisser-Greenhouse conservative *F* test to the data. If statistical significance is observed on both tests, then it is safe to conclude statistical significance. If, however, the

conservative test is not significant and the first test is, then the adjusted *F* test is used to reach a final conclusion (p. 586-588).

The test of the interaction using a two-factor analysis of variance where one factor is repeated was not statistically significant, $F(1,31)$, $\hat{\eta}^2 = .09$, although, the interaction does explain a small percentage (9%) of variance. The dependent *t* test determined that there is no statistically significant difference between pre- and posttest scale scores, $t(32) = 1.26$, $\hat{\eta}^2 = .05$.

The next research question is will the amount of change from pre- to posttest epistemological beliefs scores for individuals with no prior teaching experience be the same as the amount of change from pre- to posttest scores for individuals with prior teaching experience? Responses to questions 1, 2, and 3 in Section II of the demographic survey yielded four categories of teaching experience that were labeled as (a) no prior teaching experience, (b) prior teaching experience, (c) not currently teaching, and (d) currently teaching. Small sample sizes resulted in further collapsing these 4 categories into 2 categories of teaching experience labeled as *no prior teaching experience* and *prior teaching experience*. Means and standard deviations for the two teaching experience groups are provided in Table 10. The posttest mean is lower than the pretest mean for scale scores for students having prior teaching experience (mean difference = 2.04), and a slight change to a lower posttest mean for scale scores was obtained by students without prior teaching experience (mean difference = .67). A graphical representation of these data using box and whiskers plots is provided in Figure 4.

INSERT FIGURE 4 AND TABLE 10 ABOUT HERE

A one-way repeated measures analysis of variance was used to test this research question. Results of evaluation of the assumption for homogeneity of variance-covariance was satisfactory. The interaction is not statically significant, $F(1, 30) = .12$, $\hat{\eta}^2 = .004$. The within subject effect of time is statistically significant, $F(1,30) = 5.29$, $\hat{\eta}^2 = .15$. Indicating greater change to sophistication on posttest means for scale scores. The between groups effect of teaching experience is also statistically significant $F(1, 30) = 7.91$, $\hat{\eta}^2 = .21$. Indicating that students with prior teaching experience are more sophisticated in their epistemological beliefs than are students with no prior teaching experience.

The next research question is to what extent will teacher-credential students' epistemological beliefs pretest means be different between individuals holding undergraduate majors in diverse areas of study? A logical collapsing of undergraduate major from question 4 under Section II from the demographic questionnaire resulted in two categories labeled as *Interdisciplinary/Humanities* and *Social/Physical/Natural Sciences* to obtain sufficient sample cell size for the analysis. Means and standard deviations for the two groups are shown in Table 11. The independent-sample *t* test determined that there is no statistically significant difference on pretest means for scale scores between students holding different undergraduate majors, $t(33) = 1.26$, $\hat{\eta}^2 = .05$.

INSERT TABLE 11 ABOUT HERE

The next research question is to what extent will teacher-credential students' epistemological beliefs pretest means be different between individuals from diverse educational institutions? Responses to question 5 in Section II from the demographic survey were collapsed

into two categories of higher-education institutional systems labeled as *Private 4-year University* and *Public 4-year University or State University* (see Table 12). The independent-sample *t* test determined no statistically significant difference on pretest means for scale scores between students from different university systems, $t(33) = 1.26$, $\hat{\eta}^2 = .01$.

INSERT TABLE 12 ABOUT HERE

The extent of the relationship between the epistemological beliefs and CBEST scores because students either forgot their score or simply reported passing. The last research question is to what degrees is family academic background related to teacher credential students' epistemological beliefs pretest scale scores. The correlation ratio was used to assess the strength of association between family educational background and pretest scale scores. Moderate correlations are found between the educational background of mother's, father's, and spouse's and students' scale scores (see Table 13).

INSERT TABLE 13 ABOUT HERE

Additional information regarding teacher-credential students' beliefs about teaching and learning was yielded from the writing task. The same two individuals from the pilot study coded statements of 5 students and then discussed their results before coding the next 5 students until all 40 writing tasks collected at posttest were evaluated. Rater agreement for the writing task as a whole was satisfactory, that is, the percentage of rater agreement for belief 1 is 97%, belief 2 is

95%, belief 3 is 95%, and belief 4 is 95%. Examples of written statements that individuals expressed clearly to each of the four targeted beliefs are provided in the following paragraphs.

Samples of individual's written statements expressing clearly the belief that it is a teacher's professional responsibility to foster learning behavior in all students for all subject are presented next. For example, as one student stated "It is the teachers responsibility to provide educational support to all students." And as proposed by the same individual, "I feel we as teachers must educate the whole child and teach all subjects."

From the view of another individual, "It is the teacher's responsibility to prepare her students for the following grade and for life in general. Discouraging a student to learn about any subject is not fulfilling a responsibility that goes with teaching." This individual also stated " I believe that it is the teacher's job to help the student acquire knowledge." These statements described clearly the belief that a large proportion of responsibility for students to learn should come from those who teach.

"As a teacher, it is your job to teach students new things and help students improve. ... All subjects are important and must be delivered to children equally." is the view held by another individual. The belief that learning all subject areas is important was explicitly expressed by the individual who stated, "A student needs to have a feeling of success and this may be a subject revealing his or her natural talent. But, all areas of education are important."

Samples of individual's written statements expressing clearly the belief that giving students the correct answer is an integral part of acquiring knowledge at the beginning when learning a new subject are presented next. For example, as one student stated "I think helping a student and working with them to find out information or modeling is alright. I think giving answers is part of learning to understand how that answer was reached." Another example is

provided by the individual who stated "Students need to know if what they are doing is right or wrong. Students need to know the correct answers and if the teacher is not clearly telling them, then who will. It is especially true if students are having a problem in a subject area." In this last example, this student stated "I think that a really good teacher would try to guide the student to the correct answer, but definitely not trick them. In the end, yes they should receive the correct answer and an explanation of how to get to that answer."

Samples of individual's written statements stating clearly the belief that the active process of continued learning deserves greater weight than simply teaching rote methods on how to solve problems are presented next. For example, as one student stated "Students should instead be taught to think critically, debate the issue, and draw conclusions based on multiple perspectives. In math and science, students benefit largely from the problem-solving process, where it has been proven that even focussing on why and how an answer is wrong is valuable."

This individual stated "I think teaching is about learning, questioning, and experience. If students are working together, motivated, and participating, then I think that is learning." From the view of another individual, it was stated that "I think this way, because we all learn differently; therefore, we will all come to an answer differently. And or sometimes come to a different answer. Things such as different perspectives, culture, background and experiences influence certain answers." Finally, as expressed by this student, "Students can not simply be fed material. They need to also know why the material is important for them to understand and learn."

Only one student expressed clearly the belief that teachers who are willing to spend extra time with a student is an indication of educators who make thoughtful decisions when stating that "There are many times throughout the course of the day (before school during lunch, after

school) when extra time can be spent on the student's weaknesses in math without having the usual time spent on the student's strengths in language skills."

Evaluations were summarized by first averaging the two codes given to individual written responses, rounding the average code to a whole number for each of the four targeted beliefs, and then computing the percentage of students in each of the 3-coded categories for each of the 4-targeted beliefs; these results are shown in Table 14. The belief that it is a teacher's professional responsibility to foster learning behavior in all students for all subject areas was expressed clearly by nearly all students (93%).

As noted in the sample of statements above there was evidence that the three remaining beliefs were expressed clearly, but not at the same rate as the first belief. The belief that giving students the correct answer is an integral part of acquiring knowledge at the beginning when learning a new subject was expressed clearly by 25% of the sample and implied by 63% of the sample. The active process of continued learning deserves greater weight than simply teaching rote methods on how to solve problems was expressed clearly by 65% of the sample and implied by 23% of the sample. The last targeted belief, teachers who are willing to spend extra time with a student is an indication of educators who make thoughtful decisions was not expressed by 93% of the sample.

As shown in Table 14, results indicate that the first targeted belief is a view expressed clearly by nearly all individuals (93%). Indeed, this particular view spread throughout written statements given to each of the three prompts. Fewer students expressed clearly the other three beliefs in Table 14 in their written statements given to each of the three prompts.

INSERT TABLE 14 ABOUT HERE

Discussion

Individuals in a teacher-credential program who are low in epistemological beliefs maturity deserves the attention of educators, as noted by Beers (1988). According to Beers, naive epistemological beliefs are likely to negatively affect on-the-spot decisions regarding teaching and if not brought to one's attention will continue to be a detriment to learning. Beers suggested teachers need to learn to reflect on their teaching so that they become aware of personally held naive epistemological beliefs.

The problem of transferring research-based knowledge to individuals preparing to teach was presented in the introduction (cf., Fenstermacher, 1994; Korthagen & Kessels, 1999). Schommer (1994) proposed that naive epistemological beliefs are probably a source of interference to teaching and learning. Pajares (1992) argued that beliefs of teachers should and must be a concern of those who have a stake in educational practice. Results from this study provide evidence that may help teacher educators and their students learn ways to reflect on and change personal epistemological beliefs at this early time of the individual's teaching career.

The distribution of scores from the 34-item Epistemological Beliefs Questionnaire for teacher-credential students in this study are nearly the same as the distribution of scores for teacher majors and community-college faculty provided by Comerford et al. (1999). Results provided by Comerford et al. have been extended in this study to conclude that maturation and education contribute to raising the level of sophistication in students' epistemological beliefs.

Yet, not all teacher-credential students have high sophisticated epistemological beliefs. Indeed, 55% of the sample were classified as moderate and 10% of the sample were classified as low in sophistication. The finding suggests that prior undergraduate college education may have helped a few but not all individuals reach a high level of epistemological beliefs sophistication.

The responsibility of raising the level of sophistication for these individuals is passed on to higher-education institutions and teacher educators so that all individuals will be trained to become thoughtful professionals as mandated by the California Commission on Teacher Credentialing (1998).

The fact that third-semester students have had two semesters of teacher training might lead to the logical conclusion that these students have had more educational experience and should, therefore, have more sophisticated epistemological beliefs on the pretest. Results show less than a one-point difference between first- and third-semester student pretest means on the 34-item questionnaire. Also, the range of pretest scores is about the same across groups. This finding suggests that individuals in the teacher-credential program have the same level of epistemological beliefs sophistication regardless of the semester in training.

It was found that teacher-credential students attending the first and third semester of the program show change to greater sophistication, where third-semester students showed the change to greatest sophistication. Moderate to large practical importance was found for the change to greater sophistication indicating the likelihood that change to greater epistemological beliefs sophistication is possible over a semester of training. There are implications of evidence that suggests that the level of sophistication in one's epistemological beliefs may be raised after one semester of teacher training.

Pajares (1992) posited that sophistication occurs slowly over time suggesting that change would be difficult if not impossible to detect in a single semester. Pajares argued that beliefs formed by personal educational experience act as a filter through which new knowledge about teaching and learning must pass. It is for this reason that well established beliefs are resistant to

change. Pajares proposed that if change in beliefs is to occur, then evidence in the form of new knowledge must be presented for the individual to reflect upon.

Findings from this study suggest that teacher-credential students who are in their first semester of training and in the process of acquiring formal psychological and philosophical knowledge about education show change in the direction of epistemological beliefs maturity. Although the interaction was not statistically significant, this finding provides evidence to support the hypotheses that change in the direction of sophisticated epistemological beliefs can be detected for individuals preparing for a teaching credential and that students in their third semester of training may experience greater change than students in their first semester of training.

As part of their training, first-semester students are required to study Philosophical Foundations and Educational Psychology, whereas third-semester students are instructed to revisit their beliefs about teaching and learning. Both provide an environment that promotes reflection on teaching and learning. Curriculum that promotes individuals to reflect on formal psychological and philosophical knowledge about teaching and learning in the beginning semester, and in a later semester instructs students to revisit their beliefs about education may have facilitated change in the direction of increased epistemological beliefs sophistication.

Schommer (1990, 1998) provided evidence that higher education, personal experience, and family background are important to the development of an individual's epistemological beliefs. A practically important difference was found between students with and without prior-teaching experience in epistemological beliefs sophistication, where students with prior-teaching experience have a statistically lower mean on the epistemological beliefs questionnaire than students without prior-teaching experience. Approximately half of the teaching-credential

students (47% in their first semester and 41% in their third semester) reported having prior-teaching experience. If students in this study taught with an emergency permit before entering the teacher-credential program, then they have received supervision from an educator who has at least 3 years of teaching experience, as required by the California Commission on Teacher Credentialing (McLean, 1999).

According to the 1997-98 Annual Report Emergency Permits and Credential Waivers (McLean, 1999), the majority (55%) of emergency permits was given to Multiple-Subjects Teaching-Credential students during the 1996-97 academic year, which represents 10% of the teachers in California public schools. Results have not been made available past 1997, but the trend has been increasing in the number of emergency credentials awarded. McLean (1999) attributed the dramatic increase in emergency permits and waivers awarded to school districts to the reduction in class size that has drawn a shortage of teachers in California schools. Substitute emergency permits and waivers are awarded to districts that hire individuals to substitute for teachers who need to take a temporary leave of absence. A 32% increase in 30-Day Substitute Emergency Permits in 1996-97 over the 1995-96 academic year were approved. Credential waivers approved for the first 6 months of 1997-98 showed a 46% increase in requests for substitute waivers over the same period in 1996-97.

Findings from this study support the conclusion that prior-teaching experience affects positive change in one's epistemological beliefs. Although, the positive effect of having obtained prior teaching experience on epistemological beliefs may not be a simple one to explain. Future research is needed to investigate the effects of prior teaching in the context of other factors, such as quality of mentoring, specific aspects of teacher training, and amount of time devoted to hands-on-experience.

Results from this study indicated that individuals holding different undergraduate majors are not statistically different in levels of epistemological beliefs sophistication. In the Comerford et al. (1999) study, it was found that upper-division (junior and senior) college students were not statistically different in the mean sophistication of their epistemological beliefs across different teacher-education majors. Both studies support the hypothesis that individuals with different choices of undergraduate major are about the same in epistemological beliefs sophistication. Majors in subjects such as Psychology, Philosophy, and English may contain curriculum that promotes greater liberal epistemic thinking than majors such as the Natural and Physical Sciences, however, the evidence does not suggest that different subjects of undergraduate study contribute to differences in epistemological beliefs sophistication.

Results indicated that individuals from different college institutions are not statistically different in epistemological beliefs sophistication. The finding suggests that undergraduate education experienced from private educational institutions in comparison with larger public universities has about the same effect on the development of epistemological beliefs for individuals in a teacher-credential program.

Results of this study indicated important relationships between family members educational background and the epistemological beliefs of teacher-credential students, where more variance was accounted for by mothers and spouses than that of fathers. Father's educational background yielded the least amount of shared variance with pretest scores, whereas spouse (if married) and mother's educational background yielded about the same amount of shared variance with individuals' epistemological beliefs pretest scores. For adults in this study, results indicate that the higher the education of family members the more sophisticated is one's epistemological beliefs. Although the sample in this study are adults in their fifth year of

education, the finding is consistent with Anderson's (1984) position that family background is as important to epistemological beliefs development for children as the effects of formal education in stating that "It stands to reason that the beliefs about knowledge that a child develops will be influenced by those of his parents" (p. 9).

The writing task constructed for this study did not serve as well as intended in revealing additional beliefs about teaching and learning. Part of the problem is that the writing task could not be used to explore responses with additional in-depth follow-up questions; therefore, responses tended to be global beliefs about the purpose of education instead of specific to learning and teaching. Respondents often neglected to support their beliefs with concrete examples of what they would do in a similar situation. Again, additional and more specific questioning may have avoided this problem. More time, however, is needed to add additional questions, which is not likely to occur during class time. Because this study used pre- and posttest methods, it was not possible to ask students to complete a longer version of the writing task at home and return it to the next class meeting without breaching anonymity. Given these limitations, four categories of beliefs were yielded from the writing task that may have been missed by the questionnaire. The four beliefs that emerged from the writing task do not seem to be unique from those found in other studies and can fit into Pajares (1992) 16 assumptions.

In the Pajares and Bengston (1995) study, it was found that language and arts preservice teachers reveal personal beliefs based on their training in formal psychological principles rather than useful teaching strategies in response to a teaching scenario. Beliefs of teacher-credential students in this study do not appear to be based on formal psychological principles but instead touch on personal views regarding the purpose of education. Perhaps teaching formal

psychological principals does not have as strong an influence on shaping the beliefs of individuals preparing to teach as that proposed by Pajres and Bengston.

According to Labaree (2000), a majority of Americans have historically kept in mind three goals of education for educators of teacher-credential programs to promote to their students as they prepare to teach: democratic equality, social efficiency, and social mobility . Consumers of education view the first two as promoting public good, whereas the latter promotes individual fulfillment. From the view of democratic equality, the purpose of educational institutions is to raise the level of competence for all citizens. From the perspective of social efficiency, the primary purpose of school is to train productive workers.

Results from the writing task indicated that most teacher-credential students believe it is a teacher's professional responsibility to foster learning behavior in all students for all subject areas and that the active process of learning deserves greater weight than teaching rote methods. This belief clearly overlap with the view that the purpose of education is to promote democratic equality.

Surprisingly, only one teacher-credential student mentioned spending extra personal time to help a student. Teacher-credential students may be reluctant to expend their effort and energy beyond the classroom to help students who are perceived as unmotivated to learn or not expected to do well in a particular subject area. Yet, this finding is inconsistent with the pattern of responses revealed by the other three belief categories. It may simply be the case that providing additional time beyond classroom teaching is not in the minds of teacher-credential students.

Conclusion

Evidence from this study supports the conclusion that teacher-credential students have reached moderate to high levels of epistemological beliefs sophistication. It is also concluded

that the epistemological beliefs of teacher-credential students may change to greater levels of sophistication in a semester of training. These findings have implications for teacher educators who emphasize that teacher-credential students reflect on teaching and learning throughout their training. Although more research is needed before it can be determined if curriculum that focuses on pedagogy or hands-on experience facilitates greater refection on beliefs about teaching and learning.

The 34-item Epistemological Beliefs Questionnaire provides a simple and efficient way for teacher educators to assess the beliefs of teacher-credential students that can be explored with further discussion and personal reflection. With more allocated time than was possible for this study, additional classroom methods such as using a simple writing task to raise one's awareness of pedagogy may help to increase epistemological beliefs sophistication.

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Table 1

Demographic Characteristics of Sample Population by Semester in Teacher Training

Demographic Characteristics	Total Sample (n = 52)		First Semester (n = 30)		Third Semester (n = 22)	
	f	%	f	%	f	%
Gender						
Male	6	11.5	5	16.7	1	4.5
Female	31	59.6	19	63.3	12	54.5
Missing	15	28.8	6	20.0	9	40.9
Race/Ethnicity						
White NonHispanic	28	53.8	18	60.0	10	45.5
Hispanic	3	5.8	2	6.7	1	4.5
Asian/Pacific Islander	3	5.8	1	3.3	2	9.1
Biracial or Other	3	5.8	3	10.0	0	0.0
Missing	15	28.8	6	20.0	9	40.9
Undergraduate Major						
Interdisciplinary	8	15.4	5	16.7	3	13.6
Social Sciences	9	17.3	5	16.7	4	18.2
Humanities	15	28.8	11	36.7	4	18.2
Physical Sciences	1	1.9	0	0.0	1	4.5
Natural Sciences	2	3.8	2	6.7	0	0.0
Other	1	1.9	0	0.0	1	4.5
Missing	16	30.8	7	23.3	9	40.9
Institutional System						
Private 4-year university	17	32.7	10	33.3	7	31.8
CU 4-year university	7	13.5	6	20.0	1	4.5
CSU 4-year university	13	25.0	8	26.7	5	22.7
Missing	15	28.8	6	20.0	9	40.9

Note that the demographic survey was given during the posttest. Missing demographic data were the result of students who only attended the pretest or dropped from the program. All teacher-credential students are in their fifth year of college education and hold a BA degree. All respondents plan to add the MA degree to their credential. CU is the California University system and CSU is the California State University system.

Table 2

Family Education Background for Sample Population by Semester in Teacher Training

Family Education Background	Total Sample (n = 52)		First Semester (n = 30)		Third Semester (n = 22)	
	f	%	f	%	f	%
Mother						
H. S. Diploma or Less	8	15.4	5	16.7	3	13.6
Technical Training or 2-Year College Degree	8	15.4	8	26.7	0	0.0
4-Year College Degree	17	32.7	8	26.7	9	40.9
Advanced Degree	4	7.7	3	10.0	1	4.5
Missing	15	28.8	6	20.0	9	40.9
Father						
H. S. Diploma or Less	7	13.5	6	20.0	1	4.5
Technical Training or 2-Year College Degree	3	5.8	2	6.7	1	4.5
4-Year College Degree	18	34.6	9	30.0	9	40.9
Advanced Degree	9	17.3	7	23.3	2	9.1
Missing	15	28.8	6	20.0	9	40.9
Spouse (if married)						
H. S. Diploma or Less	0	0.0	0	0.0	0	0.0
Technical Training or 2-Year College Degree	4	7.7	4	13.3	0	0.0
4-Year College Degree	8	15.4	4	13.3	4	18.2
Advanced Degree	4	7.7	4	13.3	0	0.0
Missing	36	69.2	18	60.0	18	81.8

Table 3

Percentage of Sample Population in Surveyed Courses in Teacher Training

Teacher-Credential Courses	f	%
Philosophical Foundations	17	32.7
Educational Psychology	13	25.0
Student Teaching I & II	22	42.3

Note: Philosophical Foundations and Educational Psychology are required courses for students in their first-semester of training. Student Teaching I & II is a requirement of individuals in their third-semester of training.

Table 4

Percentage of Sample Population for Semester in Teacher Training by Teaching Experience

	Total Sample (n = 52)		First Semester (n = 30)		Third Semester (n = 22)	
Teaching Experience	f	%	f	%	f	%
No Prior Experience	13	25.0	9	30.0	4	18.2
Prior Experience	23	44.2	14	46.7	9	40.9
Missing	16	30.8	7	23.3	9	40.9

It was determined that respondents' teaching experience is independent of their semester in training as indicated by Chi-square = .25, *df* = 1. One cell dropped below a frequency of 5, however; Fishers exact test confirmed these results.

Table 5

Distribution for the Number of Items Within Questionnaires and the Proportion of Items With Item Calibrations Greater Than .50 by Schommer's (1990) Five Epistemological Beliefs Dimensions

Five Dimensions of Epistemological Beliefs	Questionnaires		
	63 item	34 item	Proportion
Certain Knowledge	11	4	.36
Omniscient Authority	10	6	.60
Simple Knowledge	19	5	.26
Innate Ability	13	9	.69
Quick Learning	10	10	1.00
Total Items	63	34	.54

Note: Schommer based her items on five dimensions of epistemological beliefs: Certain Knowledge, Omniscient Authority, Simple Knowledge are directly derived from Perry's (1970) work, and Innate Ability and Quick Learning were contributed by Schommer.

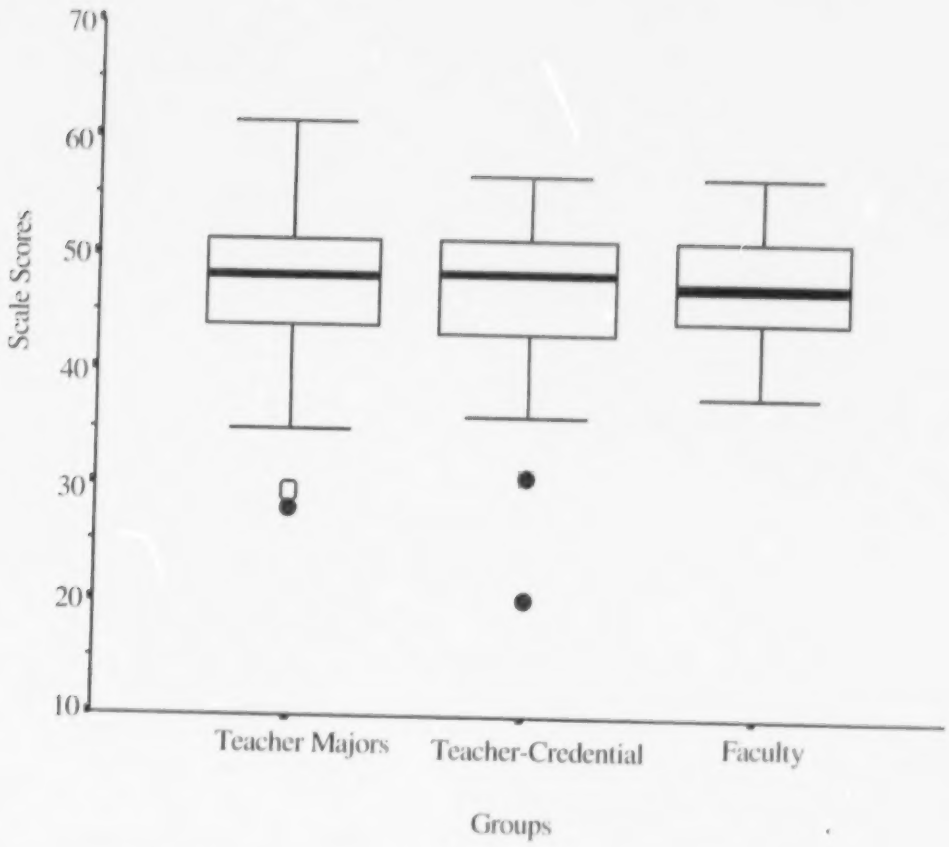

Figure 1. Box-and-whiskers plots of distributions for sophistication in epistemological beliefs scale scores for teacher-credential students in this study and teacher majors and faculty from Comerford et al. (1999).

Table 6

Distribution of Means and Standard Deviations for the 34-Item Epistemological Beliefs Questionnaire by Teacher Groups

Group	n	Mean	SD
Teacher Majors	170	47.43	6.21
Teacher-Credential Students	52	47.19	6.66
Community-College Faculty	28	47.26	5.35

Schommer's (1990) 63-item epistemological beliefs questionnaire was administered to Junior and Senior students majoring in teaching during the 1991 to 1992 academic year and to community-college faculty during the 1999 academic year. Teacher credential students in this study were administered the shorter 34-item version (Comerford et al., 1999). All scale scores, however, are linear transformations of raw scores from items on the 34-item questionnaire.

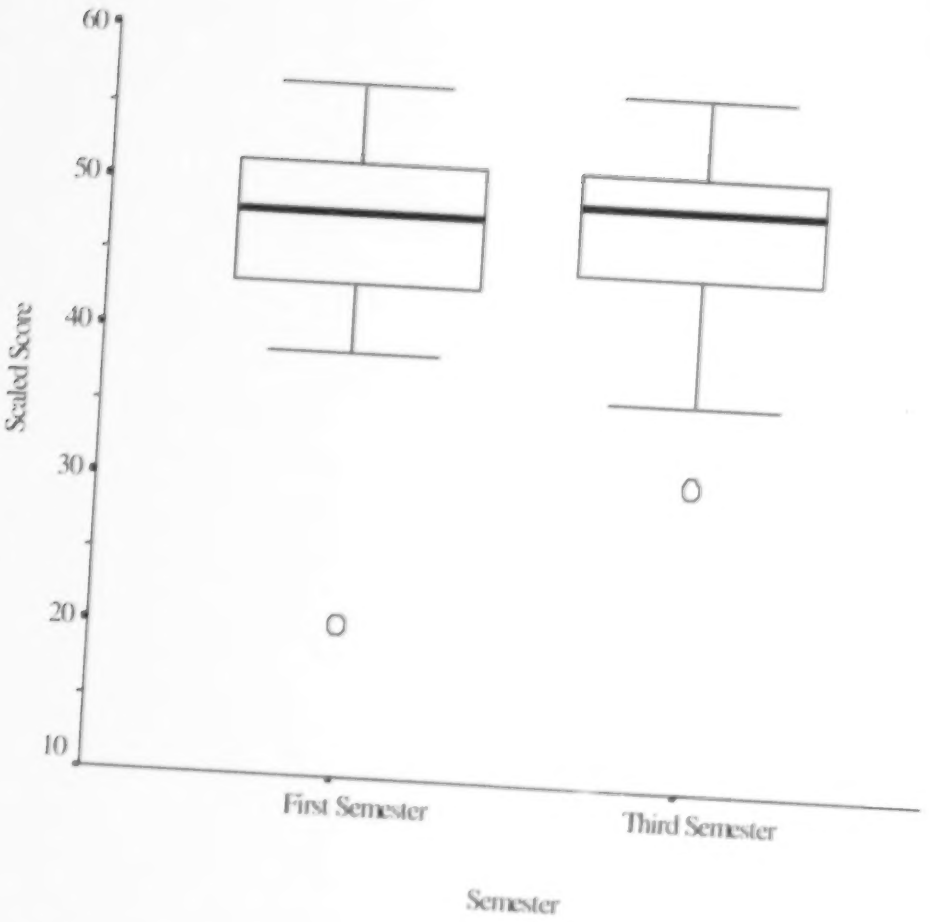

Figure 2. Box-and-whiskers plots displaying epistemological beliefs pretest scores by semester in training teacher-credential groups.

Table 7

Means and Standard Deviations for Epistemological Beliefs Pretest Scores by Teacher-Training Groups

Groups	n	M	SD	Low	High
First Semester	30	46.89	6.95	20.17	56.70
Third Semester	22	47.60	6.38	30.72	56.70
Total	52	47.19	6.66	20.17	56.70

Note: Philosophical Foundations and Educational Psychology were in attendance by first-semester students and Student Teaching I and II were in attendance by third-semester students during this study.

Table 8

Percentage of Students in the Levels of Epistemological Beliefs Sophistication

Level of Epistemological Beliefs Sophistication	f	Percentage
Sophisticated	18	34.6
Moderate Sophistication	29	55.8
Low Sophistication	5	9.6
Total	52	100

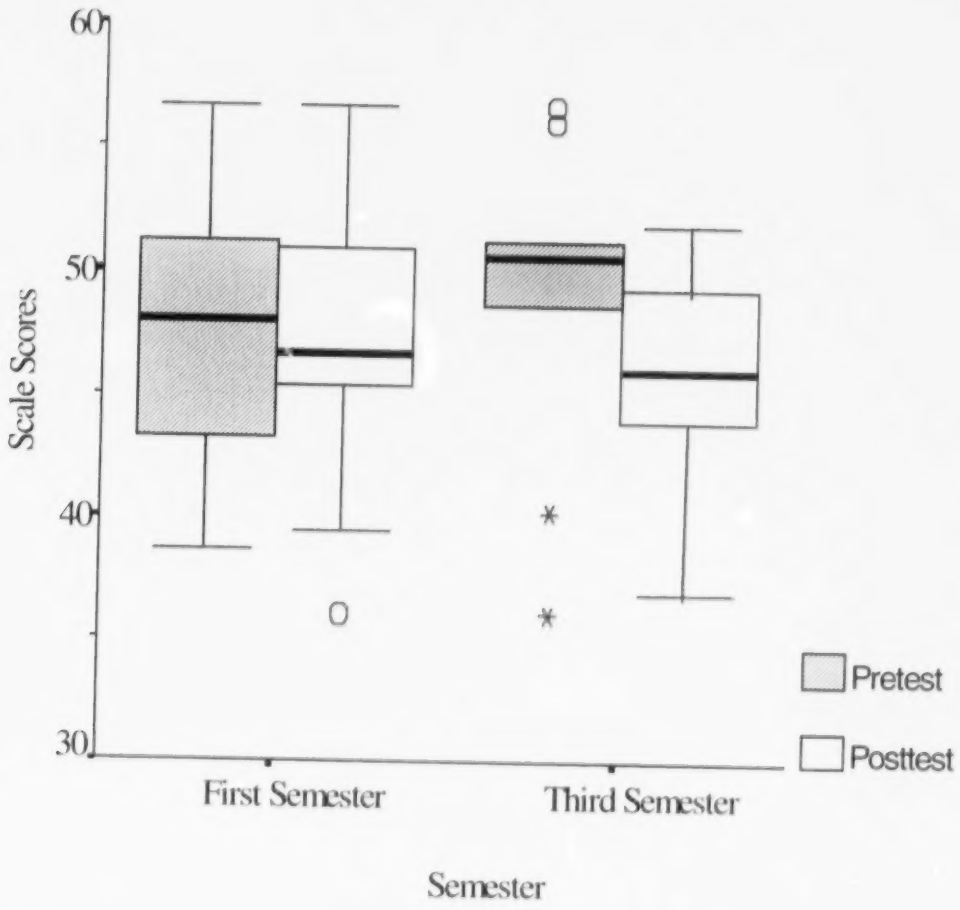

Figure 3. Box-and-whiskers plots displaying epistemological beliefs pre- and posttest scores by semester in training teacher-credential groups.

Table 9
Means and Standard Deviations for Epistemological Beliefs Pre- and Posttest Scale Scores by Teacher Training Groups

		Pretest		Posttest		Difference	
Groups	n	M	SD	M	SD	M	SD
First Semester	24	47.68	4.99	47.49	4.70	.19	3.08
Third Semester	9	48.94	6.78	45.64	4.48	3.30	7.49
Total	33	48.02	5.45	46.99	4.65	1.03	5.03

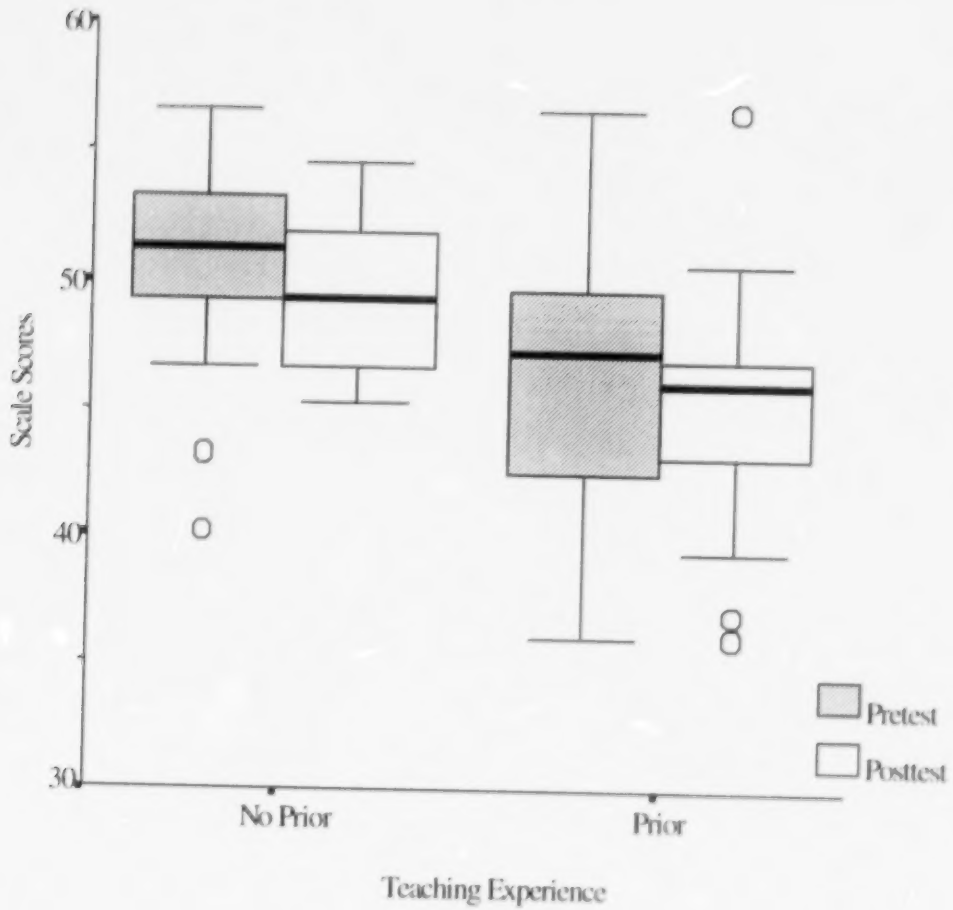

Figure 4. Box-and-whiskers plots displaying epistemological beliefs pre- and posttest scores by teaching experience.

Table 10

Distribution of Means and Standard Deviations for Pre- and Posttest Epistemological Beliefs Scale Scores by Type of Teaching Experience

	Type of Teaching Experience			
	No Prior Experience (n = 12)		Prior Experience (n = 20)	
	Mean	SD	Mean	SD
Pretest	49.67	4.51	47.04	5.96
Posttest	49.26	3.33	45.34	4.71

Table 11

Distribution of Means and Standard Deviations for Pretest Epistemological Beliefs Scale Scores by Undergraduate Major

Undergraduate Major	f	Mean	SD
Interdisciplinary/Humanities	23	48.65	5.23
Social/Physical/Natural Science	12	46.27	5.47
Total	33	47.83	5.35

Table 12

Distribution of Means and Standard Deviations for Pretest Epistemological Beliefs Scale Scores by Undergraduate Institution

University System	f	Mean	SD
Private 4-year University	17	47.49	5.12
Public 4-year University or State University	20	48.71	5.73
Total	37	48.15	5.42

Table 13

Correlation Between Measures of Family Educational Background and Students' Epistemological Beliefs Scale Scores

Family Educational Background	f	%	$\hat{\eta}^2$
Mother			.19
High School diploma or less = 1	8	15.4	
Technical training or 2-year college degree = 2	8	15.4	
4-year college degree = 3	17	32.7	
Professional degree = 4	4	7.7	
Missing	15	28.8	
Father			.11
High School diploma or less = 1	7	13.5	
Technical training or 2-year college degree = 2	3	5.8	
4-year college degree = 3	18	34.6	
Professional degree = 4	9	17.3	
Missing	15	28.8	
Spouse (if married)			.17
High School diploma or less = 1	0	0.0	
Technical training or 2-year college degree = 2	4	7.7	
4-year college degree = 3	8	15.4	
Professional degree = 4	4	7.7	
Missing	36	69.2	

Table 14
Frequency and Percentage of Teacher-Credential Students in Four Belief Categories by Rating

Belief	Not Expressed		Implied		Expressed Clearly	
	f	%	f	%	f	%
It is a teacher's professional responsibility to foster learning behavior in all students for all subject areas.	0	0.0	3	7.5	37	92.5
Giving students the correct answer is an integral part of acquiring knowledge at the beginning when learning a new subject.	5	12.5	25	62.5	10	25.0
The active process of continued learning deserves greater weight than simply teaching rote methods on how to solve problems.	5	12.5	9	22.5	26	65.0
Teachers who are willing to spend extra time with a student is an indication of educators who make thoughtful decisions.	37	92.5	2	5.0	1	2.5

Appendix

Raw Score Conversion Table for 34-Item Questionnaire
(Mean = 50, SD = 20)

Raw Score	Logit	New Scale
0		-6.5
1	-4.4	5.65
2	-3.72	12.80
3	-3.29	17.07
4	-2.98	20.17
5	-2.74	22.63
6	-2.53	24.67
7	-2.36	26.45
8	-2.20	28.01
9	-2.06	29.43
10	-1.93	30.72
11	-1.81	31.91
12	-1.70	33.02
13	-1.59	34.07
14	-1.49	35.06
15	-1.40	36.01
16	-1.31	36.91
17	-1.22	37.78
18	-1.14	38.61
19	-1.06	39.42
20	-.98	40.21
21	-.90	40.98
22	-.83	41.72
23	-.75	42.46
24	-.68	43.17
25	-.61	43.88
26	-.54	44.58
27	-.47	45.26
28	-.41	45.94
29	-.34	46.61
30	-.27	47.28
31	-.21	47.95
32	-.14	48.61
33	-.07	49.26
34	-.01	49.92
35	.06	50.58
36	.12	51.24
37	.19	51.90
38	.26	52.57

Table continues on the next page.

Table Con't.

Raw Score	Logit	New Scale
39	.32	53.24
40	.39	53.91
41	.46	54.60
42	.53	55.29
43	.60	55.99
44	.67	56.70
45	.74	57.43
46	.82	58.17
47	.89	58.92
48	.97	59.70
49	1.05	60.49
50	1.13	61.31
51	1.22	62.16
52	1.30	63.04
53	1.40	63.96
54	1.49	64.92
55	1.59	65.93
56	1.70	66.99
57	1.81	68.13
58	1.93	69.34
59	2.07	70.66
60	2.21	72.10
61	2.37	73.69
62	2.55	75.47
63	2.76	77.58
64	3.01	80.07
65	3.32	83.21
66	3.75	87.54
67	4.47	94.74
68		106.74

Note. From *The effects of a critical-thinking component in an English composition course on the epistemological beliefs of community-college students* (pp. 211-212), by S. S. Comerford, 1999, (Doctoral dissertation, University of San Francisco). *Dissertation Abstracts International*, 9926652. Reprinted with permission. Raw scores are based on recoding the 5-point Likert response scale to 01222.

TEACHER-CREDENTIAL STUDENT
WRITING TASK
Spring 2000

Your participation in this study with the completion of this writing task will help provide insight into the teaching and learning process. Specifically, I am interested in what type of beliefs about teaching and learning students working toward a Teaching Credential hold. At the bottom of this page is a student and teacher scenario that you might have experienced already or will experience in your teaching and learning career. Following the teaching and learning scenario are three questions for you to respond to with a brief paragraph indicating how you *personally* view teaching and learning. There are no right or wrong answers. It is important to answer all questions with as much detail as you consider necessary to express your views on the subject.

Teaching and Learning Scenario

One of Adrian Stone's students has entered the new school year with below average math and science test scores near the 45th percentile. The student, however, has high-test scores in reading and language near the 90th percentile and appears interested in these subjects. The teacher is concerned that the extra effort and time needed to increase the student's achievement in math and science may not be very fruitful and even reduce the amount of time allocated to the student to learn reading and language skills. The teacher has decided to concentrate on helping the student improve his or her natural talent to learn language skills and advises the student to do the best she or he can with math and science.

QUESTION ONE[1]

Based on your knowledge of learning, how would you evaluate the teacher's decision? Would you handle the situation the same or differently? Provide as much detail as necessary to express your beliefs regarding the following situation and the teacher's feedback to the student. Please make sure to state ***why*** you are responding in that way, that is, what is your thinking and your beliefs about teaching and learning in this case?

QUESTION TWO

Do you agree Adrian arrived at the best decision for the student because of a belief that the student will gain greater benefits by learning reading and language skills quickly instead of spending time struggling with learning math and science?

QUESTION THREE

Do you agree or disagree with the belief that regardless of the subject matter or age of students, teaching and learning is most effective when the teacher provides unambiguous correct answers to students who are experiencing difficulty understanding a problem? Please make sure to state ***why*** you are responding in that way, that is, what is your thinking and your beliefs about teaching and learning in this case?

---

[1] Questions have been grouped here to save space. For the study, each question will be printed on a separate page to provide room for written paragraphs

Teacher-Credential Student Demographic Survey

Directions: There are no right or wrong answers for the following questions. The survey is intended to provide information regarding your background and teaching experience. Use a number 2-pencil to bubble in a point under each question. Some questions, however, are open-ended and will require a short written response. It is important to answer all questions to provide complete information.

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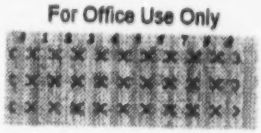

SECTION 1: BACKGROUND

Please answer all questions.

1. What is your gender?
   - ( ) Male
   - ( ) Female

2. What is your race/ethnicity?
   - ( ) White NonHispanic
   - ( ) Black NonHispanic
   - ( ) Hispanic
   - ( ) Asian or Pacific Islander
   - ( ) Biracial or Other

3. What semester are you in the teacher-credential program?
   - ( ) First semester
   - ( ) Third semester

4. What Teaching-Credential Program are you studying in?
   - ( ) Special Education Program, Mild/Moderate Education Specialist
   - ( ) Multiple Subjects Credential with a CLAD emphasis
   - ( ) Multiple Subjects Credentail with a BCLAD emphasis

5. Do you plan to go for or attain the M.A. degree in this program?
   - ( ) Yes
   - ( ) No

6. What course(s) are you enrolled in for the current semester?

   _____

7. What was your CBEST score? _____

8. What was the primary reason that led you to decide to study for a teaching credential?

   _____

   _____

   _____

Please continue on the other side of the page.

Teacher-Credential Student Demographic Survey (continued)

9. What is the highest level of educational attainment for the following individuals?

Self	Spouse	Mother	Father	Highest Educational Attainment
( )	( )	( )	( )	No High School Diploma
( )	( )	( )	( )	High School Diploma
( )	( )	( )	( )	Some College
( )	( )	( )	( )	Associate of Arts Degree
( )	( )	( )	( )	Bachelor of Arts Degree
( )	( )	( )	( )	Master of Arts Degree
( )	( )	( )	( )	Doctorate or Professional Degree
( )	( )	( )	( )	Don't Know or Does Not Apply

SECTION 2: TEACHING EXPERIENCE

1. How many years of full-time teaching experience do you have?

( ) None
( ) Two years
( ) One year or less
( ) Three to five years
( ) More than five years

2. How many years of part-time teaching experience do you have?

( ) None
( ) Two years
( ) One year or less
( ) Three to five years
( ) More than five years

3. How many hours a week do you currently teach?

_____

4. In what area was your undergraduate major?

( ) Interdisciplinary
( ) Humanities
( ) Natural Sciences
( ) Social Sciences
( ) Physical Sciences
( ) Other (Please specify) _____

5. At what type of institution did you earn your undergraduate degree?

( ) Private 4-year university
( ) Public 4-year state university
( ) Public 4-year university
( ) Other (Please specify) _____

6. Where is the location of the institution from which you received your undergraduate degree?

_____

THANK YOU FOR YOUR TIME AND EFFORTS IN COMPLETING THIS SURVEY!